INFLUENCE OF CARBON ADDITION ON SINTERING BEHAVIOUR IN ULTRAFINE WC-Co POWDER

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"I declare that the content present in this thesis are my own work which was done at UniversitiTeknologi MARA (UiTM) unless stated otherwise. The thesis has not been previously submitted for any other degree."

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ABSTRACT

Tungsten carbide cobalt, WC-Co composites are essentially aggregates of particle of tungsten carbide bonded with cobalt metal via solid-state sintering. Ultrafine-grained WC-Co composites have potential to replace standard materials for tools and wear parts because of their tremendous mechanical properties especially on hardness and toughness. However, one of the crucial aspects in fabrication fine-grained WC-Co using powder metallurgy route is during sintering stage. Inappropriate sintering temperature may contribute to lower mechanical properties. Lower sintering temperature will lead to incomplete sintering while too high sintering temperature constituting the driving force for the grain growth process. The aim of this investigation was to study the optimum sintering temperature of WC-Co with carbon addition. In this work, ultrafine-grained powder of WC was used and sintering is conducted at liquid-solid-state in gas environment of 95% nitrogen and 5% hydrogen. Samples were fabricated through powder metallurgy route and sintered at three different temperatures which is 1350 ˚C, 1400 ˚C and 1450 ˚C and held for 1 hour. The effect of carbon addition in WC-Co composite towards the mechanical properties; density, hardness, transverse rupture strength, and microstructure formation at varies sintering temperature were examined using standard test procedures. The results signify that the fabricated samples produced higher density and hardness compared to commercial WC-Co cutting tools.